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Department of Energy

Richland Operations Office
P.O. Box 550
Richland, Washington 99352

JUL 11 1995

Mr. Steve M. Alexander
Perimeter Areas Section Manager
Nuclear Waste Program
State of Washington
Department of Ecology
1315 W. Fourth Avenue
Kennewick, Washington 99336-6018

Mr. Douglas R. Sherwood
Hanford Project Manager
U.S. Environmental Protection Agency
712 Swift Boulevard, Suite 5
Richland, Washington 99352-0539

Dear Messrs. Alexander and Sherwood:

REVISED RESPONSES TO COMMENTS ON THE FOCUSED FEASIBILITY STUDIES (FFS) AND PROPOSED PLANS FOR THE 100-HR-3 AND 100-KR-4 GROUNDWATER OPERABLE UNITS (OU)

Attached please find the U.S. Department of Energy, Richland Operations Office (RL), summary of responses to comments on the FFS reports and proposed plans for the 100-HR-3 and 100-KR-4 OUs (Attachment 1), and the 100-KR-4 (Attachment 2) and 100-HR-3 (Attachment 3) responses to State of Washington, Department of Ecology (Ecology), and U.S. Environmental Protection Agency (EPA) comments to the FFS and proposed plans for the OUs. These documents have been revised to reflect agreements between RL, EPA, and Ecology from a June 21, 1995, comment resolution meeting. To expedite review of this material, revision bars were added in the right margin to highlight text that was modified as a result of the comment resolution meeting.

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If you want to discuss this matter further, please contact Mr. David E. Olson at 376-7326.

Sincerely,

Julie K. Erickson, Director
River Sites Restoration Division

RSD:DEO

Attachments: As stated

cc w/attachs:
L. E. Gadbois, EPA
D. P. Holland, Ecology
R. W. Scheck, MACTEC
W. W. Soper, Ecology
J. W. Yokel, Ecology

cc w/o attachs:
R. L. Biggerstaff, BHI
G. R. Eidam, BHI
W. E. Remsen, BHI
R. C. Wilson, CHI

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SUMMARY OF RESPONSES TO COMMENTS ON FOCUSED FEASIBILITY STUDY REPORTS AND PROPOSED PLANS FOR THE 100-HR-3 AND 100-KR-4 OPERABLE UNITS

INTRODUCTION

Revisions to the focused feasibility study (FFS) reports and proposed plans for the 100-HR-3 and 100-KR-4 Operable Units will be made to reflect the newly developed strategy for these operable units and to respond to review comments from the U.S. Environmental Protection Agency (EPA) and the Washington State Department of Ecology (Ecology).

PROPOSED STRATEGY FOR 100-HR-3 AND 100-KR-4 OPERABLE UNITS

A strategy for the 100-HR-3 and 100-KR-4 Operable Units has been developed since EPA and Ecology provided comments on the FFS reports and proposed plans to the U.S. Department of Energy, Richland Operations Office (RL). This strategy reflects some of the issues raised in the regulatory agency comments, as well as some other significant changes. The following list summarizes the major elements of the strategy, proposed plans to address them, and how RL proposes to modify the FFSs.

- <u>Preferred Alternative for Interim Remedial Action</u> Recent sampling results indicate that hexavalent chromium is present at several locations in the riverbed sediment pore water, at concentrations exceeding ambient water quality criteria for the protection of freshwater aquatic life. RL agrees with the EPA and Ecology preference for groundwater pumping and treatment (known as the pump-and-treat process) as the preferred alternative for interim action toward protection of the Columbia River. The 100-HR-3 and 100-KR-4 FFSs and proposed plans will be revised to reflect this agreement.

- <u>Focus Interim Remedial Measures on Ecological Receptors</u> The strategy confirms that the Tri-Parties will continue to follow the Hanford Past Practice Strategy interim remedial measure (IRM) pathway, which will be focused on protection of ecological receptors. The primary ecological receptors of concern are salmon eggs, alevin, and fry.

  The need for aquifer restoration activities to protect potential human receptors will be determined in either a subsequent record of decision (ROD) for interim action or in the final ROD for the groundwater operable unit. RL will work with EPA and Ecology to include appropriate statements in the FFSs and proposed plans that indicate how and when potential human receptors will be addressed.

SUMMARY OF RESPONSES TO COMMENTS ON FOCUSED FEASIBILITY STUDY REPORTS AND PROPOSED PLANS FOR THE 100-HR-3 AND 100-KR-4 OPERABLE UNITS

- Interim Remedial Measure Performance Objectives EPA and Ecology have indicated that the performance objective for the IRM will be ambient water quality criteria for the protection of freshwater aquatic life in the Columbia River sediment pore water (i.e., at the point of potential exposure of aquatic receptors). Pending development of a means to relate shoreline groundwater concentrations to concentrations in the riverbed sediment pore water, the regulators have also suggested an alternate performance objective of 50 μg/L of hexavalent chromium in shoreline groundwater. Revisions to the FFSs and proposed plans will use these values as initial performance objectives for the IRM. They may be revised as experience with the IRM is gained.

FOCUSED FEASIBILITY STUDY AND PROPOSED PLAN COMMENTS

EPA and Ecology provided both general and detailed comments on the FFS reports and the proposed plans. Some of these comments are addressed by the general strategy items identified above. Of the remaining comments, those that are primarily editorial in nature will be implemented directly. The major technical comments relate to the FFS cost estimates and groundwater modeling; these are discussed below.

- Cost Estimates RL will reexamine the FFS cost estimates and make adjustments as appropriate. Included in this effort will be application of appropriate cost information derived from the Boomsnub Superfund (e.g., *Comprehensive Environmental Response, Cleanup, and Liability Act* [CERCLA]) site groundwater pump-and-treat system for chromium remediation. Cost components such as the number of wells, flow rates, well installation costs, types of resins, resin backflushing frequencies, and sludge disposal quantities will be reexamined. The potential cost savings of automating the system are already being evaluated.

- Modeling A large number of EPA and Ecology comments relate to the FFS groundwater modeling performed for the comparative evaluation of alternatives. RL agrees with many of these comments and proposes to perform additional detailed modeling during remedial design (supported by site-specific hydrologic testing to determine treatment capacity, well spacing, and predicted performance). In this design modeling effort, RL will address all of the modeling comments provided.

  Qualifying text will be added to the current modeling section of the FFS to describe the usage and limitations of the model in supporting alternative selection.

SUMMARY OF RESPONSES TO COMMENTS ON FOCUSED FEASIBILITY STUDY REPORTS AND PROPOSED PLANS FOR THE 100-HR-3 AND 100-KR-4 OPERABLE UNITS

OTHER ITEMS

During comment resolution, RL would like to discuss several additional issues with EPA and Ecology related to the FFS reports and proposed plans. These include the following.

- *National Environmental Policy Act* Appropriate *National Environmental Policy Act* (NEPA) evaluations must be included in the FFS reports and proposed plans. RL has made similar revisions to FFSs for source operable units and anticipates that this activity will not interfere with completion of the documents in accordance with the proposed schedule.

- Recent Data Recently collected data are available and could be used to update the chromium plume geometries assumed in the FFSs. Performing such updates, however, would not fundamentally change the results of the FFS, nor would it change the preferred alternative. RL recommends against updating the nature and extent of contamination "snapshots" used for the FFS reports. RL will use the most recent data to support IRM remedial design for the preferred alternatives.

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100-KR-4 OPERABLE UNIT
Responses to Regulator Comments on
the Focused Feasibility Study Report (DOE/RL-94-48, Draft A)
and the Proposed Plan for Interim Remedial Measure (DOE/RL-94-113, Draft A)

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INTRODUCTION TO RESPONSES

In the time since the U.S. Environmental Protection Agency (EPA) and the Washington State Department of Ecology (Ecology) provided review comments on the *100-KR-4 Operable Unit Focused Feasibility Study Report* and the *100-KR-4 Operable Unit Proposed Plan for Interim Remedial Measure*, the Tri-Parties have moved toward agreement on a strategy for interim remedial measure (IRM) action for the 100-HR-3 and 100-KR-4 groundwater operable units. A summary of the strategy is included with this comment response package.

The U.S. Department of Energy, Richland Operations Office (RL) has formulated the following responses to regulator comments on the focused feasibility study (FFS) and the proposed plan to reflect this strategy. To help focus on key changes and issues, the following general responses are provided. These general responses are referred to within responses to specific comments, where appropriate.

A. Preferred Alternative for Interim Remedial Measures Recent sampling results indicate chromium concentrations in excess of the EPA ambient water quality criteria of 11 $\mu g/L$ (hexavalent chromium) in riverbed sediment pore water in salmon spawning areas. RL agrees with the EPA and Ecology preference for groundwater pumping and treatment as the preferred alternative for an IRM. The IRM's objective is the protection of the chinook salmon spawning habitat and other sensitive ecological receptors in the Columbia River. The system will be designed to intercept and treat groundwater contaminated by hexavalent chromium, thereby reducing the concentration of chromium that may be discharging through salmon spawning habitat in the river. The proposed plan will be revised to reflect this agreement. The general format for the groundwater proposed plans will be changed to be consistent with that adopted for the source operable unit proposed plans.

B. Focus Interim Remedial Measures on Ecological Receptors The strategy confirms that the Tri-Parties will continue to follow the Hanford Past Practice Strategy IRM pathway. Based on recent agreements between EPA, Ecology, and RL, the IRM will be refocused on the protection of ecological receptors. The primary ecological receptors of concern are salmon eggs, alevin, and fry. The FFSs and proposed plans will be revised to provide both human health and ecological risk information, but emphasize ecological risks as the basis for IRMs.

   The need for aquifer restoration activities to protect human receptors will be determined in either a subsequent record of decision (ROD) for IRM or in the final ROD for the groundwater operable unit. Innovative and emerging technologies for aquifer restoration will be further evaluated at that time. RL will coordinate with EPA and Ecology to include appropriate statements in the FFSs and proposed plans to indicate how and when potential human health receptors will be addressed.

100-KR-4 OPERABLE UNIT
Responses to Regulator Comments on
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C. Interim Remedial Measure Performance Objective EPA and Ecology have indicated that the performance objective for the IRM will be the EPA ambient water quality criteria for protection of freshwater aquatic life. For hexavalent chromium, the contaminant of concern, the criterion for chronic exposure is 11 μg/L. The goal of the IRM is to protect the chinook salmon spawning habitat, which is within gravelly sediment to a depth of about 12 to 18 inches. Since it is logistically difficult to monitor this habitat, monitoring at the river shoreline has been suggested as a compliment to the performance monitoring methodology. The regulators have suggested an initial performance objective of 50 μg/L, measured in temporary well points that are positioned near the high-water mark of the river. This objective will be revised during IRM if new information indicates a more appropriate concentration.

D. Modeling Associated with the Focused Feasibility Study and Remedial Design A number of EPA and Ecology comments relate to the FFS modeling performed for the comparative evaluation of alternatives. As indicated in the strategy summary, RL agrees with the regulators' preferred alternative of groundwater extraction and treatment as an IRM to protect the Columbia River, and will perform detailed hydrologic analyses and modeling to determine well numbers, well spacing, and extraction rates during the design phase.

RL feels that the modeling currently presented in the FFS, when combined with the analysis against the standard *Comprehensive Environmental Response, Cleanup, and Liability Act* (CERCLA, also known as Superfund) evaluation criteria, supports selection of groundwater extraction and treatment as an appropriate IRM toward protection of the Columbia River.

E. Cost Estimates EPA and Ecology provided comments on the remedial alternative cost estimates presented in the FFS. RL will reexamine these cost estimates and make adjustments as appropriate. Included in this effort will be application of appropriate cost information derived from the Boomsnub Site (a Superfund site) groundwater pump-and-treat system for chromium remediation. Cost components such as the number of wells, flow rates, well installation costs, types of resins, resin backflushing frequencies, and sludge disposal quantities will be examined. The potential cost savings of automating the system are already being evaluated.

100-KR-4 OPERABLE UNIT
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FOCUSED FEASIBILITY STUDY REPORT

GENERAL COMMENTS

1. The proposed plan states that EPA, Ecology, and DOE have selected institutional controls and continued current actions as the preferred interim remedial alternative. EPA and Ecology do not support that selection.

   RESPONSE: The proposed plan will be revised to identify pump and treat as the preferred IRM alternative.

   Also see "Introduction to Responses" item A.

2. The chronic water quality criteria for Cr^{+6} is 11 ppb and is supported with relevant toxicity data. Growth of algae (importance to the food chain) have been shown to be inhibited at 10 ppb; 16 to 21 ppb in the medium resulted in reduced growth of rainbow trout and chinook salmon fingerlings (species of concern). The near-river wells identified in DOE/RL-94-113 Draft A as the point of compliance have concentrations from several to ten times those of the criteria/toxicity data, yet the DOE proposal is to stay-the-course. Use of near-river well contaminant levels to calculate the ecological risk has been the agreed-upon approach by the Tri-Parties for several years. The basis has been that at times of low river flow, groundwater discharges into the river at contaminant concentrations that can approximate that observed in the near-river wells. Near river wells have been a convenient monitoring point. River bank springs and seeps data over the years has supported the assumption. The risk assessment results indicate a real risk to juvenile salmon. The Proposed Plan must be for active remedial action to protect the salmon and any other sensitive organisms in the river gravels.

   DOE/RL-94-113 identified three alternatives with active remediation. One would be a containment wall, the most expensive and environmentally destructive; and two pump-and-treat alternatives. The pump-and-treat alternatives, as outlined by DOE are very expensive. Pump-and-treat actions should not be nearly as expensive as estimated by DOE, based on actual costs at other sites. An overly expensive design and cost estimation is not appropriate reason to forgo active remediation based on a cost-benefit comparison. At this time, pump-and-treat should be the preferred alternative with an understanding that flexibility to use other remedial actions that are equally protective will be entertained for future modification to the remedial design. The DOE/RL-94-113 proposal of institutional controls/continued current actions perpetuates rather than remediates the current risks.

   We recommend evaluation of an alternative that addresses the following components:

   * In-situ treatment to convert most of the Cr^{+6} to Cr^{+3}.
   * Ramp-up such that full scale pump-and-treat is on line within 15 months post ROD.

RESPONSE: **The document will be revised to state that EPA ambient water quality standards (e.g., 11 μg/L for Cr^{+6}) will be used to protect ecological receptors in the Columbia River. See also "Introduction to Responses" items B and C.**

RL will reexamine cost estimates used in the FFS and make any necessary adjustments. See also "Introduction to Responses" item E.

New or emerging treatment technologies will either be addressed as part of the final ROD for the groundwater operable unit or in a subsequent IRM ROD to protect potential human receptors, should that become necessary. Examples of characterization or treatability studies currently under way or planned for the near future are as follows:

- **Salmon habitat characterization studies to be conducted during the Fall 1995 and Fall 1996 spawning seasons**
- **Characterization of groundwater immediately adjacent to river (wellpoints)**
- **Ongoing CERCLA groundwater operable unit sampling and analysis**
- **Numerical modeling of the flow regime**
- **Conceptual site model development**
- **Treatability studies on in situ groundwater remediation technologies.**

3. Section 4.0 of the FFS report presents an evaluation of the alternatives. In each containment or treatment alternative the groundwater model is relied upon to estimate the effectiveness of the alternative. Each alternative should also be directly evaluated with respect to its ability to meet the preliminary remediation goals (PRGs) established in Section 3.4.

RESPONSE: **This comment has been noted. Each alternative will be evaluated qualitatively with respect to its ability to improve groundwater quality at the groundwater-river interface.**

4. Finally, there are inconsistencies in the FFS report, as noted in the specific comments that follow. Such inconsistencies should be clarified in the response to these comments to make the FFS easier to understand.

RESPONSE: **The inconsistencies will be clarified.**

SPECIFIC COMMENTS

5. Figure ES-1, page ESF-1; Table 6-4, pages 6T-4i and 4j; Table 6-5, pages 6T-5j and 5k; and Figure 8-1, page 8F-1, of the FFS; and Table 3 of the proposed plan, page 15. Figures ES-1 and 8-1 of the FFS, and Table 3 of the proposed plan indicate that Alternatives GW-5 and

GW-6 are identical except for implementability. In this category, alternative GW-5 is rated as good, and alternative GW-6 is rated as fair (less implementable). Tables 6-4 and 6-5 of the sections discussing implementability of these two alternatives, show no difference, however. The reason for the difference in overall rating should be noted in these tables, or the figures should be revised to show that these alternatives are equally implementable.

RESPONSE: Table 6-5 will be modified to show that reverse osmosis has more implementability issues than ion exchange.

6. Page 1-2, Section 1.2. This section states that the section discussing the detailed analyses (Section 6) compares each alternative to the nine CERCLA criteria. In fact, Section 6 compares only seven of the nine CERCLA criteria. The remaining two, regulatory and community acceptance, will be discussed as part of the record-of-decision (ROD) process; hence, they are not discussed in this document. Section 1.2 should be corrected accordingly. At this time, and State and EPA concur with Proposed Plan for pump-and-treat with ion exchange (GW-5) and that can be stated in the proposed plan.

RESPONSE: Section 1.2 of the FFS will be revised to clarify how the nine CERCLA criteria are used in the remedial investigation/feasibility study (RI/FS) process. Also, as presented in item A in the "Introduction to Responses," the proposed plan will be revised to present a groundwater pump and treat alternative as the preferred alternative for IRM to protect the Columbia River.

7. Page 1-9, Section 1.6.2, 2nd paragraph, last sentence. The statement "Equilibrium tests showed that the adsorption potential for Dowex 21K for uranium and chromate was far higher than the amount of groundwater available for spiking" should be rephrased into meaningful units such as column volumes. Contrary to the statement, there is clearly plenty of groundwater in the 100-KR-4 operable unit that could be spiked to cause "break though" in the treatment column. We have had discussions to indicate that the Dowex resin that DOE is using for the 100-HR-3 treatability test is good for uranium but not particularly good for chromium. We suggest that you be in touch with Cybron of New Jersey (1-800-678-0020) for information on alternate resins. EPA has had good success with their resin at the Boomsnub NPL site.

RESPONSE: The information presented in the FFS was taken from the treatability study documents. Additional information will be included, as available. There are other resins available that may be better performers than Dowex 21K; however, the treatability study performed in support of the 100 Areas used only Dowex 21K and two other resins. An effort will be made during the design phase to optimize the resin selection.

8. Page 1-9, 3rd bullet. The statement "No breakthrough was observed in water from Well 199-H4-4 for chromium or uranium" should indicate the number of column volumes this represents.

RESPONSE: The text will be revised to reflect the fact that a total of 1660 column volumes were run from well 199-H4-4 without observable breakthrough for chromium or uranium.

9. Page 1-9, 4th bullet. The statement "Breakthrough for chromium occurred at 100 ppb; therefore, 1925 ppb was taken up by the ion exchange resin" is confusing. Would this be better expressed as mass removed?

   RESPONSE: The text will be changed to reflect the fact that breakthrough for chromium occurred at 1100 column volumes from well 199-D5-15.

10. Page 1-9, 6th bullet, 1st sentence. Performance goals are mentioned but not identified or referenced. They should be.

    RESPONSE: The performance goals will be referenced.

11. Page 2-1, Section 2.1, 2nd paragraph, 2nd sentence. It is stated that samples were collected from 22 wells, but figure 2-1 apparently shows only 21 wells.

    RESPONSE: The text and Figure 2-1 will be revised to indicate that samples were collected from 18 wells. This is consistent with information included in the 100-KR-4 limited field investigation (LFI), which was published in July 1994.

12. Page 2-2, Section 2.1, last sentence. Zinc is also listed as a COC, why are only chromium and carbon-14 presented as maps? Also, the sentence should include the time period of the concentrations in figures 2-2 and 2-3 (June/July '93).

    RESPONSE: The zinc data will be reviewed to determine if a plume map is viable, and the map will be incorporated, if possible. The time period will be included on Figures 2-2 and 2-3.

13. Page 2-2, Section 2.2, 3rd paragraph. The document states that "maximum concentration data from near-river wells only were used. This data represented a conservative estimate of concentrations available for biological exposure at the groundwater-river interface." We have pointed out the fallacy of this statement in many meetings and written comments in many different forums in the past but it seems to have made no difference. This could be in error for many reasons. For example:

    * Groundwater from any one well is collected for a few minutes during a few days of each year. This is minute fraction of the time groundwater is actually flowing past this point. Several data points collected in a naturally variable system statistically is unlikely to include the maximum concentration at that well.

* Near-river wells are scattered along the river. Do they intercept the maximum part of each plume, or can the worst part of a plume pass undetected between wells with only the more dilute edges sampled?

* Contaminants are not vertically homogeneous. Vertical profile data from the Yakima barricade have indicated this for background. Operable unit waste entering the top of the water table creates a vertical profile. The monitoring wells, on the other hand, integrate the contaminant concentrations over the screened interval (typically 20 feet). The vertical structure of contaminants is at a much finer scale than this. These different strata enter the river bottom in different zones, thus creating a mosaic of contaminant zones in the river bottom pore water.

  Our groundwater monitoring process tends to integrate across much of this micro-detail. Sessile organisms, on the other hand, are exposed to the detail.

* Where groundwater begins to mix with river water, the pH, Eh, hardness etc. changes dramatically. This can cause reductions in solubility that creates a zone of contaminant concentration (increasing toxicity). The chemical form can change (increasing or decreasing toxicity). Interaction with other river chemical or physical factors can cause synergistic, potentiation, antagonistic effects.

  Blanket statements such as in this document should be removed. And please don't keep putting statements such as this in other future documents as well.

RESPONSE: Section 2.2 summarized the results of the previously prepared qualitative risk assessment (QRA). RL feels that the overall approach used in the QRAs, and subsequently in the FFSs for assessing ecological risks tends to overestimate, rather than underestimate risks to aquatic and riparian ecosystems. That was the intent of the phrase in the third paragraph. RL agrees that the wording of the phrase, "These data represent a conservative estimate of concentrations available for biological exposure at the groundwater-river interface," can be misleading. This paragraph will be revised. A suggested revision is as follows: "Maximum concentrations of the contaminants of potential concern (COPCs) from near-river wells were used in the ecological evaluation section of the QRA. These data were selected to represent concentrations potentially available for biological exposure at the groundwater-river interface."

We agree with EPA and Ecology that the maximum representative concentration, selected according to a process approved by representatives of the three agencies, may not reflect the actual maximum concentration in the 100-KR-4 Operable Unit, and that spatial and temporal variations in contaminant concentrations must be considered.

This section will also be revised to indicate that the EPA ambient water quality criteria for the protection of aquatic organisms will be used as the criteria to assess protection of aquatic receptors in the Columbia River.

14. Page 2-2, Section 2.2; and page 2T-3, Table 2-3. The last sentence on this page states that the frequent-use scenario identified tritium, carbon-14, and arsenic as COCs, based on either: (1) a medium or high incremental cancer risk (ICR); or (2) a hazard index (HI) > 1. Table 2-3 shows that chromium and nitrate/nitrite should be included as well as COCs under the frequent-use scenario. The sentence on page 2-2 should be corrected accordingly.

RESPONSE: As per recent agreements between EPA, Ecology, and RL, Section 2.2 will be revised by RL to indicate that the assessment of risks and the evaluation of alternatives for IRM will focus on protecting ecological receptors. Also see item B in the "Introduction to Responses."

15. Page 2-3, 2nd paragraph, 5th line. The statement "These constituents were not identified in the river" is false. Most of these contaminants are measured in the river. There is a plethora of PNL documents showing levels of contaminants in the river.

RESPONSE: The statement made in the referenced sentence was based on the data set used to evaluate risks in the QRA and FFS; in those samples the constituents in question did not occur at concentrations above the detection limits. We agree that many of these constituents have been reported in the Columbia River at levels above the detection limits, based on more extensive data sets. The text will be revised accordingly.

16. Page 2-3, 3rd paragraph, last line. The statement "great uncertainty exists in the potential risk associated with this media" needs rephrasing. Something like the following would be more accurate: "the potential for risk exists, however the magnitude of effects has not been quantified."

RESPONSE: The text will be revised to reflect the above suggestion.

17. Page 2T-1, Table 2-1. Chromium in the Columbia river has been detected.

RESPONSE: See comment response 15.

18. Pages 2T-3 through 2T-6; Tables 2-3 through 2-6. These tables summarize human and ecological risks associated with specific COCs. Rather than listing a quantity for the HI and risks in these tables, qualitative statements are made, such as "above," "below," "low," "medium," or "very low." Specific values for HIs and risks should be listed to assist in the elimination of uncertainty. Also, the alternatives outlined in this FFS report are based on ecological risk for acute exposure; the COCs for this exposure scenario are chromium, carbon-14, and zinc. These tables do list qualitative evaluations of risk for the human health frequent-user scenario. It should be noted that five COCs (chromium, arsenic, nitrate/nitrite, tritium, and carbon-14) all are above acceptable risk levels in this scenario. This indicates that

a remedial action is required. Any interim remedial measure that is instituted should be compatible with cleanup of these compounds, since it is likely that expansion of the interim remedial measure will be the final action at this site.

RESPONSE: **The quantitative values for the human health (hazard index and incremental cancer risk) and ecological hazard quotients will be used in the tables. The text will clearly state the basis for the numerical values. The uncertainties involved in the estimation of risks will be discussed in the report; these uncertainties are essentially the same, regardless of whether the report presents quantitative values or qualitative statements. Also, see "Introduction to Responses" item B.**

For ecological risks, the emphasis will be on chronic, rather than acute, exposures for two reasons. First, the estimated risks should reflect the continuing migration of contaminants into the river over a long period of time. Second, the chronic ambient water quality criteria are lower than the acute values, and are therefore more protective of the aquatic receptors. The potential for acute exposures, however, will not be ignored in the analysis.

The contaminants of concern for ecological receptors, as determined by the QRA, are chromium, carbon-14, and zinc.

19. Page 2F-1, Figure 2-1. Which of the wells are the 7 "new" ones mentioned in Section 2.1? There are well locations with no labels (add labels or remove well symbols).

RESPONSE: **Figure 2-1 will be revised to show which of the 7 wells were drilled for the 1994 limited field investigation. In addition, labels will be added to all previously unlabeled wells.**

20. Page 3-1, 4th bullet. The QRA reviewed contaminants individually -- interactive effects were ignored. Also, MTCA, a potential ARAR for this CERCLA action does not label a 1×10^{-4} risk as acceptable.

RESPONSE: **For human health risks, the QRA did consider the potential cumulative effects of contaminants. The total risks from carcinogenic contaminants were calculated and hazard indices were calculated for the noncarcinogenic contaminants. These values are presented in the QRA. For ecological receptors, there is no established protocol for evaluating interactive effects quantitatively. For radiological contaminants, the total risk of exposure to ionizing radiation can be estimated; this accounts for the cumulative effects of several radiological contaminants. The potential for interactive effects of non-radiological contaminants will be discussed qualitatively, based on the information available in the existing literature.**

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21. Page 3-5, Section 3.4. This paragraph states that the preliminary remediation goal of 50 micrograms per liter (μg/L) is the compliance point for near-river wells. The COC for this compliance point should be specified, although the COC in question appears to be chromium.

    RESPONSE: The PRG of 50 μg/L (which could be adjusted, pending development of more data) is for chromium, and will be noted as such. The river shoreline drive points (to be installed) will be used as performance indicators to determine whether or not the pump-and-treat system is adequately protecting the Columbia River. See also "Introduction to Responses" item C.

22. Page 4-4, Section 4.3.1, 1st paragraph, 2nd sentence. It is stated that sheet pile technology is not considered implementable in the Hanford formation due to the presence of boulders. We concur.

    RESPONSE: No response was requested.

23. Page 4-5, Section 4.3.4. The third sentence indicates that the containment system would result in an 85 to 88 percent reduction in chromium entering the river during the period of interim remedial measure. If this is a reduction in mass loading or concentration at the shoreline nodes then the sentence should be revised to so indicate. This section should also address whether the PRGs will be satisfied by this alternative.

    RESPONSE: The sentence will be revised to clearly state that the percentage of reduction refers to the mass load. This section will also be revised to qualitatively evaluate the capability of the alternatives to improve groundwater quality at the groundwater/river interface.

24. Page 4-7, Section 4.5.1. This section describes the removal and ion exchange treatment alternative. The first paragraph states that nitrate is not identified as a COC in 100 K Area groundwater, and hence that the biodenitrification process can be eliminated from the treatment system at this site. However, nitrate/nitrites are identified in Table 2-3 as above the acceptable HI for frequent human use. Because the final action at this site will likely consist only of an extension of the interim remedial measure, this system should allow for addition of nitrate treatment for the final action, if still appropriate at that time.

    RESPONSE: Treatment technologies such as biodenitrification will either be addressed as part of the final ROD for the groundwater operable unit or in a subsequent IRM ROD to protect potential human receptors, should that become necessary. Also, see comment response 14.

25. Page 4-8, Section 4.4, 2nd sentence. It is stated that in-situ treatment of the COCs in 100-KR-4 will not be considered. At the recent 33rd Hanford symposium on health and the environment, a presentation was made on the use of an in-situ permeable barrier (in this case using zeolites to stop strontium migration). The technique is reportedly being considered for use in the 100-N Area and may be of value in 100-K.

RESPONSE: **A statement will be added to Section 4.0 (the introductory section for all the alternatives presented in the FFS) reflecting the fact that emerging technologies will be evaluated as they become available and may become part of a subsequent interim ROD (if necessary) or the final groundwater ROD. Also, see comment response 2 for a list of characterization activities and treatment technologies/demonstrations that are either under way or planned for the near future.**

26. Page 4-9, Section 4.5.3, 4th paragraph, 1st sentence. It is stated that treated system effluent would be injected back into the aquifer. If this is an "operational consideration", why wasn't this injection included in the modeling analyses?

RESPONSE: **It is agreed that water injected back into the aquifer should be included in the groundwater model. RL proposes to use this, and other information, in performing the detailed hydrologic analyses and modeling to determine treatment capacity and well spacing during the design phase of the pump-and-treat system. The text will be revised to reflect this intent. Also see "Introduction to Responses" item D.**

27. Page 4-10, Section 4.5.2, 1st paragraph. It is stated that the placement of wells was optimized based on maximum capture of chromium, reduction of contaminated groundwater migration to the Columbia River, and minimization of extraction of river water. Did the optimization testing include placement of the wells parallel to the river and through the center of the plume (at least the trench portion)? This would place the wells farther from the river (reducing uptake of river water) and in the area of highest chromium concentration.

RESPONSE: **This comment has been noted. The basic assumption of the FFS is that protection of the Columbia River is the objective. Therefore, a system that addresses the center of mass of the plume does not meet the objective, at least not in an interim time frame. Therefore, optimization of well placement was done within the context of intercepting the plume at the river's edge and within the confines of the model. As stated in the text, further optimization would be a part of remedial design.**

28. Page 4-10, Section 4.5.4, 1st paragraph, 6th sentence. It is stated that the injection system was not modeled for evaluation of alternatives. The planned pumping system would remove 1100 gpm from the ground-water system. This could have a very large effect on the ground-water flow patterns. The flow patterns that result from pumping without reinjection vs. the patterns that result from pumping with reinjection may be very different. How does the 1100 gpm compare to the overall ground-water flow through the operable unit?

RESPONSE: **See "Introduction to Responses" item D and comment response 26.**

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29. Page 4-10, Section 4.5.4, second paragraph. This section describes modeling results; these results are not compared to the PRGs, but should be. The concentration of COCs entering the river should also be identified.

    RESPONSE: See "Introduction to Responses" item D and comment response 23.

30. Pages 4-10 and 4-11, Section 4.6. This section describes the removal/reverse osmosis alternative. Again, the biodenitrification process is not included in this section, although it was specified as part of the reverse osmosis treatment in an earlier DOE (1994) document. As discussed in the comment on Section 4.5.1, the design of this system should allow for the addition of biodenitrification to remove nitrates.

    RESPONSE: See comment response 24.

31. Page 4-15, Section 4.7.5, second paragraph. This paragraph indicates that the thickness of the plume has not been delineated, which brings up the point of how any of the alternatives being considered (GW-3, -5, or -6) can be evaluated with sufficient confidence. The plume thickness should be indicated.

    RESPONSE: The report will be revised to discuss the limited information available regarding plume thickness.

32. Page 4-15, Sections 4.7.5 and 4.7.6. These sections describe uncertainties with alternatives GW-5 and GW-6. The uncertainties associated with major data gaps indicate that selection of an alternative should wait until additional modeling and treatability studies have occurred.

    RESPONSE: This comment has been noted. The text will be revised to reflect the fact that pump and treat is an IRM, and will state that additional information must be collected and analyzed as part of the evaluation and selection of the final remedy. Also see "Introduction to Responses" items A and D.

33. Page 4F-1, Figure 4-1. The location of the cross-section should be shown in a map view. Lithologies "SPZ/"(K-31 and -33), "S G"(K-33, -32B, and -18), and "Z/G"(K-32B) are used but are not included in the key. Lithologies "SPZ", "GS", "SZG", "ZG", "SZ", "Z/CA", "SZCA", and "GSZ/" are include in the lithologic key but are not used in the figure. "Hanford fm." and "Ringold fm., Unit C" are listed as geologic units in the key but do not appear in the figure. Also, geologic unit "EO" appears in the figure but not in the key.

    RESPONSE: This comment has been accepted. The suggested revisions will be made so that the text and figures are consistent.

34. Section 5.0. The figures in Section 5 were produced at a scale that is difficult to read; 11" by 17" figures would be much more useable.

    RESPONSE: An 11- by 17-inch figure will be provided.

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35. Page 5-1, Section 5.2.1.1, 2nd sentence. It is stated that MODFLOW was selected based on DOE-RL 1991b. This reference does not specify MODFLOW as a "recommended" code.

RESPONSE: See item D in the "Introduction of Responses."

36. Page 5-1, Section 5.2.1.2, 2nd bullet. The assumption is made that there is no vertical flow between the unconfined aquifer and the underlying layers. During ground-water modeling of the 100-BC-5 Area (recent FFS), it was determined necessary to include flow from the deeper aquifer. The 100-BC Area is very similar to 100-K. The vertical head differences (according to head maps in PNL-10082) appear to be greater at 100-K than at 100-BC and other aspects of vertical flow (geometry, hydraulic properties, etc.) are similar in the two areas.

RESPONSE: See item D in the "Introduction to Responses."

37. Page 5-1, Section 5.2.1.2, 2nd bullet. The assumption of uniform streambed thickness is not needed. The modeling approach (using CRIV, see page 5-4) uses head loss between the aquifer node and the river, not a head loss across the streambed. Also, the assumption of uniform depth of the river is not warranted. River bottom altitudes are available ("Columbia River Navigation Studies - 1986" by the USACOE). The available data indicate that the river bottom altitude is about 348 to 356 ft for most of the 100-K Area. For the purposes of the modeling in this document the values of river bottom altitude play a part in the formulation of the river conductance values.

RESPONSE: See item D in the "Introduction to Responses."

38. Page 5-2, Section 5.2.1.2, last sentence. The modeling results are stated as being conservative because the mixing zone was not simulated. However, the use of an average river stage ignores the possibility of high river stages which may mobilize contaminants in the vadose zone. The non-conservative nature of this aspect of the modeling should be stated.

RESPONSE: See item D in the "Introduction to Responses."

39. Page 5-2, Section 5.2.2.1, 1st sentence. Simulating the flow system in a single layer requires the assumption that there is no significant vertical head gradient in the unconfined aquifer. This assumption should be stated as well as any evidence to support its validity.

RESPONSE: See item D in the "Introduction to Responses."

40. Page 5-2, Section 5.2.2.2. It is not clear from the discussion in this section where the model boundaries lie in figure 5-1.

RESPONSE: See item D in the "Introduction to Responses."

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41. Page 5-2, Section 5.2.2.3, 2nd sentence. The head elevations used along the constant-head boundary should be shown in a figure.

    RESPONSE: See item D in the "Introduction to Responses."

42. Page 5-2, Section 5.2.2.3. The groundwater contour map on which the boundary and initial conditions are based should be shown.

    RESPONSE: See item D in the "Introduction to Responses."

43. Page 5-3, Section 5.2.2.3, 1st line. The water levels used are specified as measured values for September 15, 1993. "Average" river stages are being used in the model (see statement in Section 5.2.1.2), therefore, the ground-water elevations should also be average values. Do the September 15, 1993 levels equate with average levels? Were the nearby 600-Area wells used in "projecting the water levels" to the model boundaries?

    RESPONSE: See item D in the "Introduction to Responses."

44. Page 5-3, Section 5.2.2.4, 1st sentence. The map of the bottom of the aquifer should be shown in a figure.

    RESPONSE: See item D in the "Introduction to Responses."

45. Page 5-3, Section 5.2.2.8. References should be provided for data presented for the Columbia River bed thickness and vertical hydraulic conductivity.

    RESPONSE: See item D in the "Introduction to Responses."

46. Page 5-3, Section 5.2.5, 2nd sentence. The recharge rate used (determined by calibration) should be supported by other information. For example, the 1993 ground-water monitoring report (PNL-10082) shows a recharge map indicating a range from 0.5 to 5 cm/yr for the 100-B/C Area. Also, the zones used should be shown in a figure.

    RESPONSE: See item D in the "Introduction to Responses."

47. Page 5-4, Section 5.2.2.8, 2nd paragraph. It is stated that September 15, 1993 river stages were used. However, on page 5-2 it is stated that average river stages were used. If the September 15, 1993 stages are indeed "average" this should be demonstrated (show plot of September 15 vs. annual trend?). The river stage values used should be explicitly indicated (figure?). Also, the river depth used (13.12 ft) is probably too small. From available data (see comment on Page 5-1, Section 5.2.1.2, 2nd bullet), the river depth ranges mostly between about 26 and 32 feet with a maximum of about 34 feet.

    RESPONSE: See item D in the "Introduction to Responses."

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48. Page 5-4, Section 5.2.2.8, 1st paragraph. The formula given is not exactly correct. CRIV is not an exact equivalent of KLW/M. CRIV is used in MODFLOW where the head loss between the aquifer and the river does not occur primarily across a discrete streambed layer but is more gradually distributed throughout the aquifer. When CRIV is used, M (streambed thickness) should be replaced by the distance from the center of the aquifer (node location) to the streambed.

    RESPONSE: See item D in the "Introduction to Responses."

49. Page 5-4, Section 5.2.2.9, 1st paragraph, 1st sentence. In addition to calibrating to water levels, the model should be calibrated to flows. In this instance flows are not well known, but reasonable limits can probably be determined. The calibration process should include checks of the validity of the calculated flows. Also, the simulated water budget should be included in this document. Do the September water levels represent "average" conditions?

    RESPONSE: See item D in the "Introduction to Responses."

50. Page 5-4, Section 5.2.2.9. Was any sensitivity testing conducted? With at least three parameters (recharge, hydraulic conductivity, and river bed conductance) being judged as uncertain, the sensitivity of the model to these parameters should be tested.

    RESPONSE: See item D in the "Introduction to Responses."

51. Page 5-4, Section 5.3.1.1, 1st sentence. MT3D is not listed in DOE/RL-91-44 as a recommended code.

    RESPONSE: See item D in the "Introduction to Responses."

52. Page 5-5, Section 5.3.1.2. The technical approach apparently includes no calibration of any sort (steady-state or transient). Transport modeling results from a completely uncalibrated model may not be suitable for selecting alternative actions.

    RESPONSE: See item D in the "Introduction to Responses."

53. Page 5-5, Section 5.3.1.3, 2nd paragraph, 2nd sentence. It is stated that the flow field solution from the steady-state model was used. Some of the transport modeling scenarios are transient simulations and include pumping wells (stresses on the flow system). Accurately modeling the transport behavior in these scenarios, requires a flow model that is calibrated to transient conditions.

    RESPONSE: See item D in the "Introduction to Responses."

54. Page 5-5, Section 5.3.1.3, 2nd paragraph. Does the model simulate only chromium presently in the ground-water plume? No continuing sources, no desorption?

    RESPONSE: See item D in the "Introduction to Responses."

55. Page 5-5, Section 5.3.1.3. References should be provided for porosity, dispersivity values, and retardation factors. The section should specifically describe how the values for these parameters were selected.

RESPONSE: See item D in the "Introduction to Responses."

56. Pages 5-5 through 5-7, Section 5.4. This section should discuss the results of the modeling with respect to how well the remedial alternatives selected satisfy the PRGs. The inclusion of percentage of mass reduction within the aquifer does not explain to the reader whether the PRGs have been satisfied. The goal is to reduce the mass loading and concentrations of COCs to the Columbia River. The results should be described in this context.

RESPONSE: See comment response 23.

57. Page 5-5, Section 5.4.1. This section should discuss the modeled results of the no-action alternative. Figure 5-4 shows the "11- ppb" contour intersecting the river in 2008. It would be helpful if the range of concentrations of nodes along the river or at the measured point of compliance were presented. This would allow the reader to see the implications of the no-action alternative. It would also be useful to present one or two more transport time scenarios to indicate how the concentration of COCs changes with time at the measured point of compliance.

Chromium concentrations based on measured data should be shown on Figure 5F-3 to allow a comparison of modeled data to observed data.

RESPONSE: See item D in the "Introduction to Responses."

58. Page 5-6, Section 5.4.2, 2nd paragraph, 3rd sentence. The length of the wall is given as 2,700 m. This appears to extend across most of the model area. This may result in nonrealistic boundary conditions (flow forced around the wall cannot exit the model laterally due to no-flow boundaries).

RESPONSE: See item D in the "Introduction to Responses."

59. Page 5-6, Section 5.4.2, 2nd paragraph, 5th sentence. Discharge rates of 20 gpm (per well?) were input to the model. MODFLOW calculates a water level only for the entire model cell (66 ft by 66 ft). Were calculations made of the expected drawdown at each well? Is there enough available drawdown at the withdrawal rates used? This comment applies to all scenarios with pumping wells (especially the 1100 gpm scenarios).

RESPONSE: See item D in the "Introduction to Responses."

60. Page 5-7, Section 5.4.3, last paragraph, last sentence. It is not clear what is meant by "residual chromium that was present prior to pumping." All chromium was present prior to pumping. Also, the reference to Figure 5-7 apparently is in error (5-7 is a water-level map).

RESPONSE: See item D in the "Introduction to Responses."

61. Page 5-7, Section 5.4.3. This section indicates that the simulation reduced the amount of chromium going to the river by 96 percent. It is important to explain whether this is in terms of mass loading or concentration of remaining discharge.

RESPONSE: See item D in the "Introduction to Responses."

62. Page 5F-1, Figure 5-1. It is not clear from the figure where the model boundaries are.

RESPONSE: See item D in the "Introduction to Responses."

63. Page 5F-3, Figure 5-3 and 5-11. This "simulation" should show chromium distribution equal to that measured in June-July 1993 (according to Section 5.3.1.2, these data were input as the current condition). Comparing this figure to June-July 1993 chromium data indicate some significant inconsistencies;
- K-22 and K-34 should show concentrations of > 150 pCi/L but are indicated as < 100
- K-21 should show concentration of 75 pCi/L but is indicated as <50
- K-20 should show concentration of 163 pCi/L but is indicated as < 150
- K-35 should show concentration of 16 pCi/L but is indicated as <11
- K-36 should show concentration of 226 pCi/L, but the figure indicates a maximum (in key) of 200

The model represents the aquifer as a single layer. This assumes that the concentration of chromium is evenly distributed vertically throughout the aquifer. Can this assumption be supported?

RESPONSE: See item D in the "Introduction to Responses."

64. Page 5T-1, Table 5-1. Well 199-K-19 is included in the table, but does not appear in Figure 5-2.

RESPONSE: Well 199-K-19 will be added to Figure 5-2.

65. Page 5T-2, Table 5-2. How do the calculated masses of chromium discharged to river or removed by extraction wells compare to the estimated total plume mass? In Section 1.5.6, the discussion of the chromium plume at 100-H (which appears in recent maps to be of similar areal extent and concentrations as 100-K) states that the plume has a total chromium mass of about 26 kg. There are calculated numbers in this table that greatly exceed this value.

RESPONSE: The masses calculated by MODFLOW are intended for relative comparisons, not absolute values. All the alternatives were modeled with

the same model. The nodes lining the river were summed for the "no action" alternative to get a baseline. The same summation was done for the other alternative, and the results were then compared to the "no action" alternative. The result is the percent reduction in mass at the river's edge.

Also see "Introduction to Responses" item D.

66. Table 6-1, page 6T-1a. This table showing alternative GW-1 (the no action alternative), indicates that there is no risk to human health, based on the occasional-use scenario in the qualitative risk assessment. This table should also show that the frequent-use scenario in the QRA did in fact indicate unacceptable human risk, and also that the QRA contains significant uncertainties.

RESPONSE: Based on recent agreements between EPA, Ecology, and RL (see item B in the "Introduction to Responses"), the comparison of alternatives for IRMs in the 100-KR-4 FFS will focus on the protection of ecological receptors. Table 6-1 will be revised accordingly. The statement regarding human health risks based on the "occasional-use" scenario will be retained. The text will address the issue of uncertainties.

67. Table 6-6, pages 6T-6a to 6f, and Appendix A. Both this table and this appendix should include the pre-transport requirements of 40 CFR 262 and the transporter requirements of 40 CFR 263 as relevant and appropriate. Although the wastes are not going off site, they will be removed from the present location for disposal in another area of Hanford. Compliance with the appropriate sections of handling and transport requirements will help ensure that the waste arrives at its ultimate destination without incident.

Also, there are four applicable or relevant and appropriate requirements (ARARs) identified in the appendix that are not discussed in Table 6-6:

- 40 CFR 264, Subpart S, proposed corrective action for solid waste management units
- 40 CFR 125.104, NPDES criteria and standards
- 40 CFR 50.12, air standards for lead
- 40 CFR 61.92, radionuclide emissions from DOE facilities

These should be added to and discussed in Table 6-6.

RESPONSE: This comment has been accepted. The transport requirements were not included in Draft A of the 100-KR-4 FFS because the wastes would not be transported off the Hanford Site. However, the intent is to comply with these requirements, and they will be discussed. Table 6-6 and Appendix A

will be reviewed, and appropriate changes will be made. Additionally, more text discussion will be added to Appendix A.

68. Table 6-6, page 6T-6b. The purpose of the discussion in the "how are requirements met" column for 40 CFR 261 is unclear. It states that "all solid wastes will be solidified prior to disposal," but it is not clear how solidification will satisfy the requirements of Part 261. The standards of 40 CFR 261 do not require solidification. This statement should be explained.

The statement in the "how are requirements met" column for 40 CFR 268 should be amended to say that all solid wastes will be treated *to meet land disposal restrictions treatment standards* prior to disposal.

RESPONSE: The wastes will be solidified, because solidification will preclude leaching and the solidified wastes will meet Toxicity Characteristic Leachate Procedure (TCLP) standards. The text will be revised to add this explanation. The text will also be amended to state that land disposal restrictions will be addressed for all hazardous wastes prior to disposal.

69. Table 6-6, page 6T-6d. The final column discussing 40 CFR 257.3-2 states that "activities will be scheduled to avoid impacts to eagles." An example of how such scheduling will reduce impacts to eagles would help to clarify this statement.

RESPONSE: Bald eagles are seasonal inhabitants at the Hanford Site and are present from about November through mid-March. When necessary, remedial activities can be restricted during this time interval to avoid impacts. This information will be added to the text.

70. Table 7-1, pages 7T-1a and 7T-1c. On page 7T-1a, it is stated that the costs for pumping and treatment are mainly influenced by well installation and pumping rates. However, the overall cost of alternative 5 (pump with ion exchange treatment) is $76.1 million; the overall cost for alternative 6 (pump with reverse osmosis treatment) is $44.3 million. This difference shows that the treatment method greatly influences costs. The point that the text appears to be making is that the objective of this remedial action is to prevent migration to the Columbia River, rather than aquifer cleanup. Aquifer cleanup would greatly increase costs because many more wells would be required, more groundwater would require treatment, and a much longer period would be required for cleanup.

On page 7T-1c, it also states that disposal costs for pumping and treatment tend to be the major cost drivers; this appears to be in direct conflict with the earlier statement. It then goes on to discuss disposal costs at the ERDF, and indicates that a relatively low value ($70/cubic yard) was assumed to estimate disposal costs at the ERDF. This paragraph discusses the effect of variable disposal costs for the ion exchange and reverse osmosis treatment options as if the two are equivalent in terms of: (1) the amount of material to be disposed of; and (2) overall cost. These two options are not equivalent for either case, and the text should be revised to reflect this. Since disposal cost uncertainties may radically affect the costs for these two options, it is important to observe how these two options vary with disposal costs.

RESPONSE: Table 7-1 will be revised to compare the two pump and treat alternatives with respect to well installation, pumping rates, the relative cost of ion exchange and reverse osmosis, and disposal quantities and costs.

71. Appendixes B and C. The cost breakdown presented in Appendix C of the FFS report was examined in detail, particularly disposal costs for alternatives GW-5 and GW-6. Tables B-1 and B-2 in Appendix B list secondary waste streams for these two alternatives. It was assumed that all secondary waste streams listed would require disposal. The following discrepancies were noted:

- Neither alternative includes disposal of tank bottom sludges, which would be generated in the tank that holds the pumped groundwater before any treatment. Page B-17, Section 1.5.3.1 of Appendix B, states that this tank would serve as a settling tank for any suspended solids; if so, the amount of waste generated could be significant. Both alternatives should include this potential source of waste.

- Neither alternative includes a biodenitrification process, although nitrates/nitrites are a concern under the frequent-user scenario, according to Table 2-3. As noted above, COCs identified under the frequent-user scenario should be treated as part of both alternatives.

- The ion exchange alternative does not apparently include costs for disposal of ion exchange filter cartridges. This cost should be included.

RESPONSE: The costs for the tank bottoms and the filter cartridges are included; however, they do not show up at the level of detail provided in the FFS. In addition, DOE-RL will reexamine these cost estimates in light of new information (such as the Boomsnub Site chromium remediation project) and make adjustments as appropriate. Also see "Introduction to Responses" item E.

72. Appendix B, page B-15, Section 1.5. The first paragraph of this section states that no modifications to alternative GW-5 for the method described by DOE (1994) are required. This conflicts with Section 4.5.1 (page 4-7), which describes these modifications. These sections should be made consistent as appropriate.

Sections 1.5.3.2, 1.5.3.4, and 1.5.3.5 describe specific unit operations that are not described in Section 4.5. These unit operations (chemical oxidation of organics, chromium reduction, and biodenitrification) were eliminated as part of the treatment system modifications discussed in Section 4.5.1. Chemical oxidation and chromium reduction should be removed from Appendix B, but biodenitrification should remain, as discussed previously.

RESPONSE: Appendix B will be revised so that the appendix and Section 4.5.1 are consistent. Chemical oxidation of organics and chromium reduction will be deleted, as suggested. The biodenitrification issue is tied to human health and land use issues, and will thus be deferred to either an interim ROD to

protect potential human receptors (if necessary) or the final ROD for the groundwater operable unit. Also, see "Introduction to Responses" item B.

73. Appendix B, pages B-25 and B-26, Section 1.6. This section describes the unit operations planned for alternative GW-6. Similar to the earlier comment on Appendix B, alternative GW-5, the air stripping/carbon adsorption unit operation is described in this system even though the modifications to the system described in Section 4.6 eliminate this unit. Also, biodenitrification is not described in this section of Appendix B, but should be; biodenitrification is clearly described by DOE (1994) as a component of the reverse osmosis groundwater treatment option.

RESPONSE: Appendix B will be revised so that the appendix and Section 4.5.1 are consistent. Chemical oxidation of organics and chromium reduction will be deleted, as suggested. The biodenitrification issue is the same as stated in the previous response.

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PROPOSED PLAN

GENERAL COMMENTS

74. Within the context of the ROD working group, the Tri-Parties have discussed format for the 100-HR-1 area proposed plan. We expect that the result of that process is changing the format and the content of the proposed plan. Those format and content changes should be incorporated into the 100-KR-4 proposed plan as well, as appropriate. This review provided for 100-KR-4 does not regurgitate those many changes, but we expect them incorporated into the next version of this document.

    RESPONSE: Now that the first source operable unit proposed plans are finalized, appropriate elements of the format used will be transferred to the groundwater operable unit proposed plans.

75. We are rewriting the 100-KR-4 Proposed Plan. It is far faster and easier for the regulators to write the Proposed Plan than to engage in protracted discussions with DOE unit managers and contractors, as happened with the 100 Area source operable units. FY'96 and'97 DOE budget planning indicates no intent to pursue active remedial action of groundwater in the 100 Area (other than 100-N springs). More recently DOE has suggested deferring 100-KR-4 (and 100-HR-3 and 100-FR-3) proposed plans until September 1997 at the earliest, and possibly September 1998. The regulators and DOE are clearly at odds regarding the importance of taking an action at 100-KR-4. Ecology and EPA believe the proper approach is to provide an action-oriented preferred alternative via Proposed Plans for public review as quickly as possible.

    RESPONSE: As per a recent request from EPA and Ecology, RL will prepare the draft proposed plan based on the experience the Environmental Restoration Contractor (ERC) Team gained during development of the source operable unit proposed plans. EPA, Ecology, and RL will then conduct a workshop to revise the draft plan into a final proposed plan.

76. The comparison with the EPA nine criteria is clearly biased towards supporting DOE's preferred alternative. This, as well as many other biases in the Proposed Plan are not addressed specifically in these comments, but will be reflected in our rewrite of the Proposed Plan.

    RESPONSE: No response was requested.

SPECIFIC COMMENTS

77. Page 2, middle of last paragraph. The document states: "While decisions regarding future use of the river and surrounding areas are still pending, potential uses include agriculture, wildlife habitat, and water-related recreation." Wildlife habitat and water-related recreation are not just

pending but are also current uses. Groundwater remedial actions have immediate beneficial effects, not just with regard to future uses of the area.

RESPONSE: Revisions will be made to discuss both short-term and long-term benefits of the remedial alternatives.

78. Page 2, last sentence. Suggest a change such as "the wild and scenic river designation would define aspects of future use of the land." Various aspects of future use, such as Tribal will not be defined in the wild and scenic river designation.

RESPONSE: Revisions will be made as suggested.

79. Figure 1. Proposed plans are supposed to be as publicly readable as possible. (1) This figure is fine as a Hanford Site/Richland Operations map, but too "busy" for a 100-KR-4 locator map. (2) Also, this map should be to show where the 100-KR-4 operable unit is located (the subject of the proposed plan). 100-KR-4 is not identified. (3) Earlier in the document the "100 K area" was also referred to by a number of identifiers including "100-K Area" "K Area."

RESPONSE: Revisions will be made so that the figure matches the format used in the source operable unit proposed plans. The title for the 100-K Area will be used consistently.

80. Page 6, 2nd action (Chromium Speciation Study). We have not been involved in the development of this study. We should be. In fact the CRIEP has identified this need and proposed activity 1A-4 "Chromium Speciation" to be done according to a regulator-approved DOW. We have not been a party to this DOW.

RESPONSE: This comment has been noted.

81. Page 8, Table 1. Values of "ND" (Not Detected) must indicate the detection limits.

RESPONSE: A footnote will be added to provide the contract laboratory quantification limits for the contaminants in question.

82. Page 11, Scope and role of action, 4-6th lines. There is no such thing as an IROD. It should be an interim remedial measure record of decision.

RESPONSE: This comment has been accepted. Revisions will be made as suggested.

83. Page 7, second column, second full paragraph. This paragraph discusses the risk basis for EPA decisions for action at a site. It states that if a site shows an incremental lifetime cancer risk range of 10^{-4} to 10^{-6}, then remedial action is generally not warranted unless there are other considerations such as adverse environmental impacts, potential for future contaminant migration, or uncertainty regarding future land use. Since future land use has not yet been ultimately determined, adverse environmental impacts are a factor, and future contaminant migration to the river is a reality, consideration of risks in the above range should be included.

RESPONSE: Based on discussions with the regulators (see item B in the "Introduction to Responses"), the IRM process for the 100-KR-4 Operable Unit will focus on the protection of ecological receptors. The paragraph referenced in this comment will be revised accordingly.

84. Page 8, Table 1. The maximum concentration of chromium measured in the springs (68 μg/L) is more than 4 times the acute ambient water quality criterion. Some localized adverse impact to the environment is likely between the springs and the Columbia River. Page 11 states that the potential for ecosystem damage caused by remedial action does not warrant remedial action based on the potential for existing ecological risks. That unsupported statement is used by DOE to justify not proposing an active remedial action. We do not support DOE's conclusion.

RESPONSE: The prediction of ecological risks is a difficult task, even when a substantial database is available for estimating those potential risks. In the case of the 100-KR-4 groundwater, there is considerable uncertainty in estimating ecological risks to the aquatic ecosystem in the Columbia River because there is very little data to evaluate the spatial and temporal distribution of the contaminants in the river sediments and the groundwater/Columbia River interface. However, as EPA and Ecology have noted, there are data indicating that ambient water quality criteria for the protection of aquatic organisms have been exceeded in the springs and, potentially, in the river substrate. RL agrees with EPA and Ecology that this potential for risk should be addressed through an interim remedial action.

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INTRODUCTION TO RESPONSES

In the time since the U.S. Environmental Protection Agency (EPA) and the Washington State Department of Ecology (Ecology) provided review comments on the *100-HR-3 Operable Unit Focused Feasibility Study Report* and the *100-HR-3 Operable Unit Proposed Plan for Interim Remedial Measure*, the Tri-Parties have moved toward agreement on a strategy for interim remedial measure (IRM) action for the 100-HR-3 and 100-KR-4 groundwater operable units. A summary of the strategy is included with this comment response package.

The U.S. Department of Energy, Richland Operations Office (RL) has formulated the following responses to regulator comments on the focused feasibility study (FFS) and the proposed plan to reflect this strategy. To help focus on key changes and issues, the following general responses are provided. These general responses are referred to within responses to specific comments, where appropriate.

A. Preferred Alternative for Interim Remedial Measures Recent sampling results indicate chromium concentrations in excess of the EPA ambient water quality criteria of 11 μg/L (hexavalent chromium) in riverbed sediment pore water in salmon spawning areas. RL agrees with the EPA and Ecology preference for groundwater pumping and treatment as the preferred alternative for an IRM. The IRM's objective is the protection of the chinook salmon spawning habitat and other sensitive ecological receptors in the Columbia River. The system will be designed to intercept and treat groundwater contaminated by hexavalent chromium, thereby reducing the concentration of chromium that may be discharging through salmon spawning habitat in the river. The proposed plan will be revised to reflect this agreement. The general format for the groundwater proposed plans will be changed to be consistent with that adopted for the source operable unit proposed plans.

B. Focus Interim Remedial Measures on Ecological Receptors The strategy confirms that the Tri-Parties will continue to follow the Hanford Past Practice Strategy IRM pathway. Based on recent agreements between EPA, Ecology, and RL, the IRM will be refocused on the protection of ecological receptors. The primary ecological receptors of concern are salmon eggs, alevin, and fry. The FFSs and proposed plans will be revised to provide both human health and ecological risk information, but emphasize ecological risks as the basis for IRMs.

   The need for aquifer restoration activities to protect human receptors will be determined in either a subsequent record of decision (ROD) for IRM or in the final ROD for the groundwater operable unit. Innovative and emerging technologies for aquifer restoration will be further evaluated at that time. RL will coordinate with EPA and Ecology to include appropriate statements in the FFSs and proposed plans to indicate how and when potential human health receptors will be addressed.

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C. Interim Remedial Measure Performance Objective EPA and Ecology have indicated that the performance objective for the IRM will be the EPA ambient water quality criteria for protection of freshwater aquatic life. For hexavalent chromium, the contaminant of concern, the criterion for chronic exposure is 11 $\mu g/L$. The goal of the IRM is to protect the chinook salmon spawning habitat, which is within gravelly sediment to a depth of about 12 to 18 inches. Since it is logistically difficult to monitor this habitat, monitoring at the river shoreline has been suggested as a compliment to the performance monitoring methodology. The regulators have suggested an initial performance objective of 50 $\mu g/L$, measured in temporary well points that are positioned near the high-water mark of the river. This objective will be revised during IRM if new information indicates a more appropriate concentration.

D. Modeling Associated with the Focused Feasibility Study and Remedial Design A number of EPA and Ecology comments relate to the FFS modeling performed for the comparative evaluation of alternatives. As indicated in the strategy summary, RL agrees with the regulators' preferred alternative of groundwater extraction and treatment as an IRM to protect the Columbia River, and will perform detailed hydrologic analyses and modeling to determine well numbers, well spacing, and extraction rates during the design phase.

RL feels that the modeling currently presented in the FFS, when combined with the analysis against the standard *Comprehensive Environmental Response, Cleanup, and Liability Act* (CERCLA, also known as Superfund) evaluation criteria, supports selection of groundwater extraction and treatment as an appropriate IRM toward protection of the Columbia River.

E. Cost Estimates EPA and Ecology provided comments on the remedial alternative cost estimates presented in the FFS. RL will reexamine these cost estimates and make adjustments as appropriate. Included in this effort will be application of appropriate cost information derived from the Boomsnub Site (a Superfund site) groundwater pump-and-treat system for chromium remediation. Cost components such as the number of wells, flow rates, well installation costs, types of resins, resin backflushing frequencies, and sludge disposal quantities will be examined. The potential cost savings of automating the system are already being evaluated.

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FOCUSED FEASIBILITY STUDY REPORT
(The original comment numbers from the April 21, 1995 letter are in parentheses.)

GENERAL COMMENTS

1. (Not numbered.) Overall, the 100-HR-3 Focused Feasibility Study appears to contain the necessary information to support the 100-HR-3 Proposed Plan. However, the document is biased toward the institutional control/continue current actions alternative. This is not the regulator's recommended direction. Due to contamination of the groundwater with Chromium (VI), and the Columbia River, it is Ecology's recommendation remediation is necessary. Furthermore, costs associated with the various remediation efforts appear to be greatly inflated. The FFS needs to provide not only justification for the costs presented, but also provide potential cost saving measures which will still accomplish the remediation. You must keep in mind, although the land-use scenario has not been agreed to, the QRA justifies the need for remediation of groundwater contamination.

   RESPONSE: **EPA, Ecology, and RL have agreed to a preferred alternative for IRMs involving remediation of chromium-contaminated groundwater in the 100-HR-3 Operable Unit (see "Introduction to Responses" item A).**

SPECIFIC COMMENTS

2. (1) Executive Summary, page ES-1, third bullet. Disagree with the wording in this bullet. The preferred alternative of GW-5 is aimed at containment (protection of the Columbia River) and aquifer cleanup).

   RESPONSE: **The executive summary will be revised to reflect recent agreements reached between EPA, Ecology, and RL (see "Introduction to Responses" item A).**

3. (2) Executive Summary, page ES-1, fourth bullet. The frequent-use scenario should be used, not the occasional-use.

   RESPONSE: **The executive summary will be revised to reflect recent commitments (see "Introduction to Responses" item B).**

4. (3) Executive Summary, page ES-1, fifth bullet. Why was 2008 used as the finite lifecycle for the IRM and 2018?

   RESPONSE: **The text will be revised and pump and treat cost models will be re-run, based on a 5-year lifecycle, to be consistent with CERCLA National Contingency PLAN (NCP) requirements.**

5. (4) Executive Summary, page ES-2, first paragraph. Add COPC's for frequent use. See page 2-2, fifth paragraph.

RESPONSE: As per recent agreements between EPA, Ecology, and RL, this paragraph will be revised to indicate that the assessment of risks and the evaluation of alternatives for IRM will focus on protecting ecological receptors.

6. (5) Executive Summary, page ES-2, second paragraph. Take out the last three sentences of this paragraph. They are confusing.

RESPONSE: The three sentences will be removed or revised to avoid confusion. This issue was also raised in the 100-KR-4 FFS comments by EPA (Page 2.2, Section 2.2, 3rd paragraph). RL's comment response is similar for both FFSs.

7. (6) Executive Summary, page ESF-1, Figure ES-1. Redo chart, or take out. Pie diagrams are confusing.

RESPONSE: This comment has been noted. RL will use an alternative presentation of the information.

8. (7) Page 1-5, section 1.5.3. What "other sources?"

RESPONSE: "Other sources" refers to numerous individual project reports, as well as the regularly-scheduled Pacific Northwest Laboratory (PNL) and Westinghouse Hanford Company environmental monitoring reports. A comprehensive bibliography of sources is presented in Weiss and Mitchell (1992).

The sentence will be rephrased to avoid any confusion as to the meaning of the term "other sources."

9. (8) Page 1-6, section 1.5.4, first paragraph. Rather confusing. Even though there is not a milestone, at this time, to evaluate the interaction, surely this information will be presented as it becomes available.

RESPONSE: The paragraph will be rephrased to clarify the Tri-Party Agreement milestones that are relevant to Hanford Site groundwater/Columbia River interaction and the impact of contaminated groundwater on the Columbia River.

10. (9) Page 1-7, section 1.5.6, first paragraph.

A. Redo numbers in this paragraph to reflect the agreed to PRG of 50 μg/L (MTCA).

B. List suspected sources. If we really think chromium contamination in the H Area is caused by contamination originating in the D Area, we need to monitor the 600 Area.

RESPONSE: The paragraph provides background information on groundwater contamination by chromium.

(A) The plume volume estimate and mass of entrained chromium will be revised to reflect amounts above 50 μg/L as follows: "Their estimates suggest a chromium plume in excess of 50 μg/L (WAC 173-200, "Groundwater Quality Criteria") to have a volume of approximately 310,000 m^3 and containing approximately 36 kg of chromium."

(B) The paragraph will be revised to add detail. Known sources for chromium in the 100-H Area are (1) coolant water leakage from the retention basins and underground piping; (2) sodium dichromate stock solution leakage associated with coolant water; (3) decontamination solution disposal in cribs, french drains, and trenches; and (4) leakage and/or spillage of waste solutions placed in the 183-H Solar Evaporation Basins. Groundwater containing chromium is also moving into the 100-H Area and the region to the north. This chromium has its origin in the 100-D Area, where sources similar to (1) through (3) above operated until the mid-1960s. Wells located in the 600 Area between the 100-D and 100-H Areas (e.g., 699-97-43, 699-46-43, and 699-91-46) are monitored for chemical and radiological waste indicators.

11. (10) Page 1-8, section 1.6, first paragraph. Include other COC's if the frequent-use scenario is used, such as technetium-99.

RESPONSE: **This paragraph summarizes treatability tests on groundwater in the 100 Areas. Contaminants of potential concern to sensitive ecological receptors will be described in the text (see "Introduction to Responses" item B).**

12. (11) Page 1-11, item 1. Identify the "wells near the Columbia River."

RESPONSE: **Language in item 1 is quoted from TPA Change Control Form, Change Number M-15-93-02, dated January 25, 1994. That form does not identify individual wells.**

In the 100-D Area, the closest wells to the river are 199-D5-20, 199-D8-55, 199-D8-54A, and 199-D8-53. Routinely monitored riverbank seepage locations are SP-110-1 and SP-110-2.

In the 100-H Area, the closest wells to the river are 199-H4-10, 199-H4-15A, 199-H4-12A, 199-H4-4, 199-H4-11, and 199-H4-13. Riverbank seepage locations include SP-150-1, SP-152-2, SP-152-3, and SP-153-1. Additionally, semi-permanent near-shore riverbed substrate sampling points were established along the 100-H Area in March 1995.

13. (12) Page 1-12, section 1.8. Fix the same three bullets as the first three comments.

RESPONSE: **The key assumptions described under the bullets will be revised to reflect recent agreements and commitments among EPA, Ecology, and RL (see "Introduction to Responses" items A and B).**

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14. (13) Page 2-2, section 2.2, third paragraph. Use numbers and explain what the numbers mean, so everyone can understand them.

RESPONSE: The numerical data expressing human health and ecological risks will be presented in tables in this section. The text will be revised to discuss these risks.

15. (14) Page 2-2 and 2-3. It was agreed to use the near river wells. Some of the contaminants have been identified in the river. Sampling is currently taking place in the salmon redds in the river.

RESPONSE: Since the limited field investigation/qualitative risk assessment (LFI/QRA) were performed, new environmental data have become available to support RODs. The initial results from sampling conducted in March 1995 indicate that, for the majority of sites sampled, chromium concentrations in riverbed substrate suitable for salmon redds are below the ambient water quality criteria of 11 μg/L. Additional field observations of chromium in salmon spawning habitat are planned for late 1995. Refer to "Introduction to Responses" item C for additional information on performance monitoring during IRMs.

16. (15) Tables 2-1, 2-2, 2-3. Put in a column of MCL's.

RESPONSE: Tables will be revised to reflect EPA maximum contaminant levels (MCLs) or other standards, as appropriate, if there is no EPA MCL.

17. (16) Page 3-1, fourth paragraph. Fix bullets to reflect previous comments.

RESPONSE: Assumptions listed under the bullets will be revised to reflect recent agreements and commitments among EPA, Ecology, and RL (see "Introduction to Responses" items A and B).

18. (17) Page 3-2, section 3.1, second paragraph. The recreational scenario will not be used. The frequent-use scenario will be used to determine remedial action goals for the IRM.

RESPONSE: The paragraph will be revised to reflect recent commitments (see "Introduction to Responses" item B).

19. (18) Page 3-2 and 3-3. Delete this paragraph, it is misleading. Also, fix COPC's to reflect frequent-use.

RESPONSE: The paragraph will be revised or deleted to reflect recent commitments (see "Introduction to Responses" item B).

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20. (19) Page 4-1, third paragraph. What technologies is the last sentence referring to? Please list them.

RESPONSE: **The paragraph will be revised to add a reference for RL's EM-50 Program. Projects relevant to 100-HR-3 groundwater will be highlighted.**

21. (20) Page 4F-3. I assume figure 4-3 is for GW-5.

RESPONSE: **The text on page 4-8 in Section 4.3.2.7, "H Area Contaminant System Implementation," contains a typo. It should refer to Figure 4-3, not Figure 4.1.**

22. (21) Page 5-1, section 5.0. Please provide Ecology with discs of all input data which was used for the modeling effort. We need to verify this model.

RESPONSE: **The numerical flow modeling used in FFSs to support the comparison of alternative IRMs has been discussed during other review cycles. Various deficiencies have been noted and discussed with EPA and Ecology on previous occasions. Refer to "Introduction to Responses" item D, which provides further information on the status of FFS modeling.**

Groundwater analytical results and water table elevation data, which are part of the input data used for flow modeling, are stored in the Hanford Environmental Information System (HEIS). They are available upon request.

23. (22) Page 5-3, section 5.2.6. Hydraulic conductivities seem too low. Provide more information and references in this area.

RESPONSE: **The range of hydraulic conductivities presented in this section are from historical work listed in Hartman and Peterson (1992) and the results of single well tests on new wells installed under CERCLA during 1992. Since the FFS modeling exercise, additional data have been obtained from the wells involved in the pilot-scale treatability test. Modeling used for remedial design will incorporate the most current estimates for aquifer hydraulic properties.**

24. (23) Page 8-1, section 8.1. Give numbers for risk associated with the frequent-use scenario.

RESPONSE: **As per recent agreements between EPA, Ecology, and RL, this paragraph will be revised to indicate that the assessment of risks and the evaluation of alternatives for IRM will focus on protecting ecological receptors. Also, as per that agreement, the appropriate human exposure scenario for the IRM time period is the "occasional-use" scenario.**

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25. (24) Page 8F-1. Fix the Figure. Take out the pie diagrams.

    RESPONSE: This comment has been noted. RL will use an alternative presentation of the information.

26. (25) Page 8T-1, 8T-2, and Sec 1.1. Provide summaries of cost data on these pages. Costs appear over-inflated. Although, the information is probably in Section 1.4, it is well hidden.

    RESPONSE: Cost data will be revised in subsequent versions of the focused feasibility study (see "Introduction to Responses" item E).

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PROPOSED PLAN
(The original comment numbers from the April 21, 1995 letter are in parentheses)

GENERAL COMMENTS

27. (1) The Proposed Plan states the USDOE preferred alternative for the 100-HR-3 Operable Unit is Institutional Control/Continued Current Actions. This is not the preferred alternative Ecology and EPA recommend. Due to Chromium (VI) levels at 10 to 40 times the chronic water quality criteria of 11 μg/L in near river wells in the D and H Areas, Ecology recommends a more active remediation alternative. The alternative should address; the continued evaluation of in-situ treatment for the reduction of Chromium (VI) to Chromium (III); and the installation and ramp-up to full scale pump and treat within 15 months post ROD in both the D and H area.

    RESPONSE: **EPA, Ecology, and RL have reached a mutual agreement on an IRM for groundwater contaminated by chromium (see "Introduction to Responses" item A).**

28. (2) There is confusion as to the Points of Compliance for groundwater cleanup decisions. Points of Compliance for the groundwater in the 100-HR-3 area are currently set at near river wells (DOE/RL-94-113, Draft A). Chromium is the Contaminant of Concern in this area with action levels set at chronic (11 μg/L) and acute (16 μg/L) Ambient Water Quality Standards for juvenile salmon (EPA, 1986). All Chromium is assumed to be toxic hexavalent Chromium.

    RESPONSE: **Methodology for characterizing the pathway that transports chromium to sensitive ecological habitats is being developed, and will include designing a performance monitoring program for IRMs. The revised plan will reflect this methodology. Refer to "Introduction to Responses" item C for the recent commitment associated with this issue.**

29. (3) There is some concern the Columbia River Comprehensive Impact Assessment (CRCIA) will not be completed in time to be of any use to remediation of this Operable Unit. Activities should not be dependent on this study.

    RESPONSE: **Reference to the CRCIA will be restricted to the discussion of final remedies, since CRCIA results may not be available in time to support interim decisions. For interim decisions, specific information on the movement of chromium from the 100-K, 100-D, and 100-H Areas to sensitive ecological habitat in the Columbia River is necessary to establish a technical basis for interim remedial actions. The CRCIA is focused on broader scale environmental impact issues in the river.**

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SPECIFIC COMMENTS

30. (1) Page 1, first paragraph. Add reference to Figures 1 and 2.

RESPONSE: References to Hanford Site and operable unit location maps will be added to the introductory paragraphs.

31. (2) Page 1, third paragraph. The FFS has not been approved by Ecology or EPA. Also, include DOE/RL-94-67.

RESPONSE: A reference to the FFS for the 100-HR-3 Operable Unit (DOE/RL-94-67, Draft A, or the most recent version) will be added.

32. (3) Page 1. Place documents listed for review in appendix.

RESPONSE: The list of supporting documents will be presented near the end of the proposed plan, following the format used in recent proposed plans for source operable units.

33. (4) Page 1, Shaded box. When was the Institutional Control/Continued Current Actions alternative picked? Are we sure the CRCIA will still be done? Recommend removing this box altogether.

RESPONSE: The preferred alternative of "institutional control/continued current actions" resulted from the focused feasibility study process. The CRCIA is currently under way, but may not provide specific information that is needed for IRM decisions. Activities (including river substrate sampling, developing methodology for performance monitoring, and improving the description of chromium transport to the river via groundwater flow) are under way to support these decisions. The proposed plan format will be revised for consistency with the source operable unit plans.

34. (5) Page 2, Site History, third paragraph. Take out the words "thought" and "possible" in the first sentence. Contamination is known! There are other potential uses of this land...cultural, residential, etc. In the second to the last sentence take out the word "potentially."

RESPONSE: The paragraph will be rephrased to reflect what is known about chromium in groundwater; chromium concentrations at points of exposure to humans and ecological receptors; and potential impacts to sensitive receptors in the river. The word "potentially" will be replaced with "has been demonstrated to be."

35. (6) Page 2, Site History, last paragraph. What else is known to have occurred in the 600 Area? The Public will want to know if any monitoring is occurring in the 600 Area.

RESPONSE: The paragraph will be expanded to summarize additional aspects of the 600 Area--most notably, the movement of chromium via groundwater flow

from the 100-D Area to the 100-H Area and the region north of the 100-H Area. The potential introduction of lead and arsenic to groundwater from past agricultural (pre-Hanford) activities will be described. Semiannual groundwater monitoring is conducted in wells located between the 100-D and 100-H Areas to track the chromium plume, as part of operable unit activities. Annual sampling of wells is also conducted by PNL as part of the Sitewide Environmental Surveillance program.

36. (7) Pages 5 and 6. On Figures 3 and 4, change concentrations to μg/L.

RESPONSE: Figure captions and contour labels will be revised to reflect units of μg/L.

37. (8) Page 7, Summary of Risk, first paragraph. Remove the two sentences starting with "Currently"...and ending with "risks."

RESPONSE: The first paragraph will be revised to reflect the recent agreement among EPA, Ecology, and RL to focus on ecological risks as the basis for IRM.

38. (9) Page 7, Human Health Risk, first paragraph, last sentence. Take out any reference to the regulators using or preferring the occasional-use scenario. The regulators prefer to see the frequent-use scenario.

RESPONSE: See comment response 37 (above).

39. (10) Page 7, Human Health Risk, third paragraph. List the unacceptable human health and ecological risks if the frequent-use scenario is used. Take out the last sentence.

RESPONSE: See comment response 37. Also, as per that agreement, the appropriate human exposure scenario for the IRM time period is the "occasional-use" scenario.

40. (11) Page 7, Human Health Risk, last paragraph. List contaminants which are above one HQ for frequent-use.

RESPONSE: See comment response 39 (above).

41. (12) Page 8. Put shaded box up front.

RESPONSE: The shaded box will be moved to the first page of the document, or will be reformatted according to the general format adopted for the source operable unit proposed plans, as appropriate.

42. (13) Page 8, first paragraph, second column. Take out this paragraph.

RESPONSE: The paragraph will be revised to reflect the recent agreement between EPA, Ecology, and RL with regard to a preferred alternative for IRMs (see "Introduction to Responses" item A).

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43. (14) Page 8, second paragraph, second column. Institutional control/continue current actions (GW-2) is not the alternative preferred by Ecology and EPA. Removal/Ion Exchange (GW-5) is the alternative recommended by the regulatory agencies.

    RESPONSE: The paragraph will be revised to reflect the recent agreement between EPA, Ecology, and RL with regard to a preferred alternative for IRMs (see "Introduction to Responses" item A).

44. (15) Page 9, first column. Change to fit with the above listed preferred alternative.

    RESPONSE: The second bullet and the paragraph following it will be revised to reflect recent agreements and commitments among EPA, Ecology, and RL regarding IRM for chromium in groundwater (see "Introduction to Responses" items A and B).

45. (16) Page 9, second column. The PRG which applies is the Ambient Water Quality Criteria for Chromium (VI) of 11 μg/L. Ecology and EPA believe the point of compliance should be new well points at the river. At this location the PRG of 11 μg/L would be applied.

    RESPONSE: The paragraph will be revised to reflect new commitments concerning the appropriate location and depth for sampling groundwater as it moves toward the river (see "Introduction to Responses" item C).

46. (17) Pages 11 and 12. All the costs appear to be over-estimated. Please provide cost data and justifications.

    RESPONSE: Cost estimates for the various alternatives are being revised. Revisions to the proposed plan will reflect new cost estimates as they are developed for a revised FFS report (see "Introduction to Responses" item E).

47. (18) Page 14. Redo Table 3. The pie diagrams are confusing.

    RESPONSE: This comment has been noted. RL will use an alternative presentation of the information.